Fred S. Keller, a Generalized Conditioned Reinforcer

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On occasions like this, invited speakers are often asked to submit titles and abstracts of talks they have not yet prepared. My strategy in such instances is to make up something so general that it will cover anything I eventually decide to say. That is what I did on this occasion. What could I say about Fred Keller in one phrase that would be appropriate for anything I might say about him in my presentation?

I think most of you would agree that I succeeded. Generalized conditioned reinforcers are good; we love them, as we loved Fred Keller. Most of us here, and many others who could not be here today, are his extended family.

Still, generalized conditioned reinforcers are complex; we often do not understand them as completely as we would like, and we often do not appreciate all they have to offer us. For example, I am sure many of you remember when Marian and Keller Breland (Breland & Breland, 1961) taught pigs to exchange tokens for food, but then the pigs started to root the tokens instead of exchanging them. The animals not only treated the tokens like food but seemed to prefer the tokens; rooting the tokens prevented them from getting real food. Might this have been an early demonstration of a real-world consequence of stimulus equivalence?

Then, Karen Pryor, carrying out clicker training, at first with dogs (Pryor, 1999) and later with children (Pryor, personal communication), reported that her students, both dogs and children, tried to take the clickers themselves. It almost looked as though they preferred the clickers over the reinforcers that the clickers signaled were coming.

And now, we find ourselves loving Fred Keller more than any of the other reinforcers he made it possible for us to receive. All of these puzzles about generalized conditioned reinforcers suggest research that still remains to be carried out.

Because *generalized conditioned reinforcement*, then, does not say everything we would like to say about him, I would like to describe some of Fred's characteristics that might help us to appreciate him even more than we already do, and in addition, might help us to understand him not only as a scientist and teacher but as a man. We often tend to forget that our most valued scientists, teachers, and career models are also men and women, people who do what they do for reasons that are human and general. I have always said that the first duty of all behaviorists is to obey the laws of behavior; if they do not, how can they expect others to believe their claim that behavior is determined, that the behavior of all organisms, including teachers, scientists, and role models, is subject to the same laws? Unfortunately, some behavior analysts seem to feel that because they know and understand the laws of behavior, they are exempt from those laws. Scientists accomplish what they do by behaving; teachers influence their students by behaving. If we set them up as our models, then we may increase their effectiveness in influencing our own behavior by looking

more closely at what influenced theirs.

Fred Keller was in many ways a remarkable man. One of the most remarkable things about him was that he never considered himself to be remarkable. I know, from personal interactions with him, that in his later years, he was genuinely puzzled about why people kept asking him to give talks at professional meetings. Indeed, in his last talks, he emphasized none of his many accomplishments and successes but instead, expressed his disappointment that his personalized system of instruction (PSI) had not been generally adopted. For example, in an invited address in 1982 to Division 2 of the American Psychological Association (Keller, 1985), he spoke as follows:

When Professor Brewer asked me to address you, I told him that I had already done so, 15 years ago … and that I hadn't had a new idea since then. That didn't seem to stop him. "You'll think of something, I am sure," he said. So I am here today to prove to you that he and I were right. (Keller, 1985, p. 4)

In other words, he was going to prove that he had not had a new idea for 15 years, and that he would, nevertheless, think of something to say. How many of us have been in that same situation but have not had the courage to admit it?

Then, he went on with a few words about the origin of PSI, and about the topic of his address. To quote him again:

In 1967, I was bursting with a great idea. This idea had come to me and three companions all of a sudden, like a bolt of lightning. They say that great ideas often occur this way. So I spoke about education—more specifically, instruction. I described a way of teaching that is known to some of you as PSI— *a personalized system of instruction*.

Today I will discuss a *new* discovery I have made. This one is based on research rather than intuition. It is derived from interviews with many teachers all over the United States, who carefully explained to me why they were unable to teach with PSI. By using the inductive method, I came to the conclusion that PSI, instead of being a bolt of lightning,

was merely a flash in the pan. (Keller, 1985, p. 4)

It is not difficult to detect a flash of bitterness here. In this vein, he went on to report the results of research interviews he pretended to have carried out with many unnamed teachers, and of library research that brought to light revelations by famous people in other disciplines who frequently made pronouncements about education, teaching, and learning.

First, he was told that an ideal teaching system had to be *selective*; it must separate the student sheep from the student goats. Second, he learned that the system must foster *competition* among the students, ensuring the survival of the fittest. Third, ideal teaching methods should be *relevant* to daily life; they should not coddle students with individual attention but should prepare them for the dog-eat-dog world that awaits them outside the classroom; they should learn to fend for themselves and cope with competition. Fourth, all students must have an *equal opportunity* to succeed, so that the failure of those with insufficient backgrounds or low IQs cannot be blamed on the teacher. Fifth, the ideal system must not be too *expensive*, although (sixth) teachers should find it financially rewarding. Otherwise, we will never be able to attract *great teachers*. Seventh, the ideal system should be *orderly and regular*, with students, whether sheep or goats, being trained to be on time, to keep appointments, and to be regular in attendance, just as in the outside world for which their education should prepare them. And finally, although a few teachers suggested that an ideal system should provide for *mastery* of each subject matter taught, other interviewees, he said, led Keller to dismiss this notion as absurd, as follows:

Do you really want your pupils to remember everything you tell them? The things

you say might live to haunt you. Besides, if every student mastered everything, then all students would look just the same to you—you couldn't tell the bright ones from the dumb ones. Moreover, you couldn't always tell whether or not something has been mastered. The student may have met the cognitive requirements but may not be able to express them in behavior. They may be stored in memory banks from which they cannot be retrieved or we may have failed to activate the proper nucleus in the proper hemisphere. (Keller, 1985, p. 5)

And so, along with Keller, we must cross subject matter mastery off the list of characteristics of the ideal system of instruction.

On the basis of these revelations from his research data, Keller went on to ask whether the ideal system now exists. He concluded that we have it right here with us, in the form of GSI, the group system of instruction:

The Ideal Teaching System:

GSI, The <u>G</u>roup <u>S</u>ystem of <u>I</u>nstruction
1. Selectivity
2. Competition
3. Relevance
4. Fairness
5. Thrift
6. Teacher Reward
7. Regularity
8. Mastery—Unnecessary

Group instruction by the lecture method provides all the requirements of the ideal system—selectivity, competition, relevance, fairness, thrift, teacher reward, and regularity. From his interviews and library research, Keller reports learning that teaching is an art, not a science, and that the best teachers are knowledgeable, prepared, entertaining, and dramatic. Teachers are artists, and teaching cannot be done by formula. One commentator, who actually did appreciate the successes of PSI, concluded, nevertheless, that it was too expensive. To increase taxes to improve education would be immoral; no one has the right to ask that of one's community. On a more optimistic note, an eminent scientist was certain that DNA technologies would soon permit us to design individual educational strategies, including the production of ideal teachers.

Having examined many sources in addition to those I have noted so briefly, Keller concluded this way:

Fifteen years ago, I believed in PSI. I thought it was an ideal system and I did my best to spread the word around. … But I was living in a dream. I can now perceive the following: The system was unrealistic and involved too many people; it was too expensive, and possibly immoral; and, in the last analysis, it was unnecessary. Some well-selected teachers and some well-selected students can look after all that we require in higher education. What we really need today is the early separation of the sheep from the goats, together with the strategies of molecular genetics. (Keller, 1985, p. 8)

Fred Keller was clearly ambitious, in that he wanted to leave his mark on the world, and he had had considerable success in doing so in many areas. For example, his experimental, theoretical, and promotional backing of B. F. Skinner's work brought him an abundance of professional and personal reinforcers; he was once president of this very organization, the Eastern Psychological Association. At an early stage in the development of the field, 90% of those working on operant conditioning were either Keller's students or those, like Schoenfeld, whom he had pointed in that direction. His pioneer work on escape behavior (Keller, 1941), using a technique that made use of light aversion in the laboratory rat, was a well-recognized precursor to later experimental, theoretical, and applied developments in the field of aversively controlled behavior. In addition, in doing that research, he taught us the importance of watching the subjects and not just recording numbers. That is how he learned that some animals who seemed unable to learn to turn off a bright light by pressing a lever or jumping over

a barrier had actually worked out their own solutions to the problem; they simply closed their eyes and buried their heads in their folded-up forelegs. Today, applied behavior analysts make great use of this observation, probably without even knowing its history, as they carry out what is now known as functional analysis, testing to determine the actual reinforcers for what seems on the surface to be nonadaptive behavior.

Keller and Schoenfeld's laboratory-based introductory course at Columbia University (Keller & Schoenfeld, 1949) gave psychology new stature among the sciences—because of it, my degree from Columbia University was not in psychology; it was a PhD in pure science. Prestigious and powerful professors in the humanities departments there did not find this conception of psychology congenial, and their pressures ultimately made it personally unrewarding for Keller and Schoenfeld to remain at Columbia, but the seed they planted had spread. As a leftover remnant of that conflict, we find Freudian psychology flourishing today not in psychology or even in psychiatry, but in departments of literature and the arts.

Our armed services' adoption of his code-voice method (Keller, 1943) for teaching the Morse code during World War II was an astonishingly successful application of basic principles of behavior analysis. The young men and women who received this training came, in a very short time, to participate effectively in our military intelligence efforts. I am aware of this personally because I was one of those who received that training and then was occupied in intercepting Japanese army radio messages—interceptions that had some spectacular results.

Keller's introduction (along with Paul Wilson) of the differential-reinforcement-of-low-rate (DRL) reinforcement schedule (Wilson & Keller, 1953) introduced a technique that laboratory and applied workers still find useful. From the evaluation of the behavioral effects of new drugs to the diminution of frequently occurring maladaptive behavior to the study of timing, the DRL schedule remains consistently effective.

And finally, his many students, who learned from him and went on to teach countless others all over the world, gave him perhaps his own most valued personal satisfactions. Among those intellectual descendants, scores became his personal friends. I know, too, that some of his deepest sadnesses came when students whom he valued passed away; I do not think Fred ever got over the death of Charlie Ferster. Notable among the students whom he treasured were those in Brazil, where he, Gil Sherman, and a small band of Brazilian students set psychology there on a new track, a track that remains flourishing to this day and has since spread internationally.

Nevertheless, in spite of these and other successes, what he perceived as his failure to promote PSI effectively left him bitter. Please do not misunderstand me here; I am not saying that Fred was a bitter man. He was not. He valued all the positive aspects of his life, those that I have just summarized and many others I have not mentioned—in particular, Frances and his children, John and Anne. But he was clearly bitter about PSI. He expressed his bitterness, however, with self-deprecating and graceful humor, and in doing so, continues to teach us. That is what I really want to emphasize. In his late presentations, he did not try to excuse himself by ranting against a hostile environment, or by accusing others of stupidity, dishonesty, incompetence, or malevolence. His bitterness was clearly directed at himself. Just as clearly, however, even in his bitterness, he continued to teach. The world is what it is, he

tells us, and when he proposed his solution to basic problems in education, he failed to take into account other people's sources of both reinforcement and coercive pressures.

His purpose, in those late talks, was not to complain, to accuse, or to justify himself. His purpose, as it was in everything he did, was to teach. With respect to PSI, he was trying to tell the rest of us that in addition to providing creative solutions to worldly problems, we have also to provide techniques for teaching the rest of the world that we are worth paying attention to, in spite of the difficulties they would experience if they tried to institute the changes we were recommending. His basic philosophy of experimentation, "Regardless of how the data turn out, the subject is always right," applies also to education. The student is always right, and student failures to meet their teachers' expectations require teachers to change their own behavior. Similarly, in our interactions with the world outside the laboratory, if the world fails to respond positively to our data-based teachings, then we have to figure out more effective ways to present those teachings.

What came across to me, from Fred's final presentations, was the realization that people in the world in general, like subjects in the more restricted laboratory and like students in the conventional classroom, are always right, even when they ignore data that we find convincing, and when they fail to adopt the suggestions we have made on the basis of those data. With respect to PSI, which has received positive support by more published studies than any other teaching method has ever achieved, the problem is much the same as in other instances when the world fails to act in what would appear to be its own best interests. We see it all the time: For example, everyone agrees that alternative sources of energy are desirable; oil and gas will run out in the foreseeable future. Oil and gas, however, are still the least expensive sources of energy and require the least innovation in methods of production and distribution. The same holds true for education. GSI, accomplished by individual instructors lecturing to large groups, is the least expensive and requires the least innovation in the training of teachers and in curriculum structure. Even worse, unlike the situation with respect to energy, there is, unfortunately, no foreseeable end to the supply of lecturers.

Fred Keller came clearly to realize that to get PSI adopted will require more than intellectual creativity in educational methodology. When we simply select as our students those who have demonstrated that they do not need any particular techniques in order to learn—that they will learn no matter how inefficient the system of instruction to which they are exposed—we cannot claim to have instructed them. That fact, however, is not sufficient to engender any desire for change within the system. Those responsible for the system look at themselves and at all the outstanding people who have gone through their system, and they conclude, "It works."

Ironically enough, among those of us here, among those of us who, in the Oriental tradition, revere Fred Keller as our teacher, how many of us did he teach via PSI? In spite of the GSI to which we were exposed, we were fortunate to find Fred; we learned from what he did. Many others are considered great teachers on the basis of much less. We learned not from what they did but from the sources to which they directed us; they arranged for us to get at those sources and to learn from them by whatever methods we had discovered worked for us. The fact that not all students have succeeded in learning, as we did, in spite of the system, is attributed not to failures of the system but to failures built into those unfortunate students, to deficiencies

brought about by such presumably insurmountable shortcomings as insufficient backgrounds, low IQs, uncaring families, and so on.

The institution of any new system, then, whether it deals with energy resources, health maintenance, drug abuse, terrorism, economic inequality, or any cultural or community-wide problem, calls not just for creative expertise within a particular topic area. The problems here require something more than behavior-analytic skill in influencing the conduct of particular individuals. To change practices that people hold onto because those practices are at the moment economically advantageous, or because they are simple to carry out, or because they are supported by tradition, it is necessary to influence large groups of people, without being concerned with particular members of a group.

Influencing large groups is not where behavior analysis has made its greatest theoretical or applied progress. Indeed, *Tactics of Scientific Research* (Sidman, 1960/1988) has taken almost as its defining feature an emphasis on the behavior of the individual, one client or subject at a time. In this sense, it has been more like the clinical practice of medicine, rather than the kind of statistical analysis that characterizes the science of epidemiology. Clinical medicine, like behavior analysis, has indeed made remarkable progress in alleviating the suffering of individuals who call on it, but one must also recognize that the greatest advances in public health have not come about through the treatment of sick individuals. Rather, we owe our growing life span and increasing freedom from disease to population-wide applications of science and of engineering technology; for example, the sciences and techniques of applied bacteriology, as in sanitation; virology, as in virus control by means of vaccination; sanitation engineering, as in modern plumbing and in garbage and trash collection and disposal; food and water purification, as in water decontamination and desalinization; and the like. The PSI system of instruction is a behavior-analytic contribution that has the potential, like successful public health measures, to exert population-wide effects, but behavior analysis has not yet come up with methods for gaining acceptance of that contribution by either the education establishment or the general public.

The same has been true of other behavior-analytic contributions to education, such as programmed instruction. Except for a few lonely voices crying out for extensions of the analysis of behavior into social groups and the recent but still largely unknown attempts to develop and apply the theoretical concept of the metacontingency, behavior analysis has not applied itself to the problem of how to gain professional and community acceptance of its potential contributions to the general welfare.

Fred Keller was never afraid to examine criticisms of the science he helped to found. When I was a student, he astonished me once by wondering aloud about our understanding of the basic concept of reinforcement. Although he had no data, he thought he had observed, in his everyday life, a curious phenomenon. It seemed to him that a positive reinforcement delivered only rarely by a father who was usually uncaring or negative had a greater effect on a child than the many reinforcers delivered by a father who was usually caring and positive. That observation stuck with me all these years, perhaps because I think I have observed the same thing. Perhaps we do not know everything we think we know. But then, I can remember Fred's response to the beginnings of applied behavior analysis; he was fascinated by data showing the effectiveness of those applications, but he was repelled by the claims some early enthusiasts were making about the generality of the jump from nonhuman research to

human applications. When those claims did eventually turn out to be largely correct, he was, of course, delighted, but he was never afraid to question extensions from basic research that he felt were premature or extravagant. And in his final contributions, he was not afraid to look for reasons for the failure of his own contributions to be generally accepted. That is what he was telling us, with his gentle humor and self-reproach, in his final communications. We, as teachers, must look to ourselves for our failures to teach successfully. He was not giving up on PSI. He was telling us that we had to pay attention to variables that we had ignored and change our teaching technique accordingly.

The final lesson, then, that I learned from Fred Keller was to question the basic methodology of our attempts to accomplish widespread behavioral change. He never did provide the answer to that question; he never did tell us what changes to make. His method of teaching had never been to tell students what to do, but rather, to set them on the search for effective changes in their own behavior. He did not overcue, nor did he provide reinforcers willy-nilly. When he saw students making approaches to behavior that promised to prove productive, and only then, the reinforcers flowed like rare wine. He was a master at shaping, even when he did not know the exact shape of the behavior he was looking for. My own personal take on those last attempts to generate and shape behavior that would help to advance PSI was to question the relevance of our basic research methodology when trying to influence behavior on a large scale, when what mattered was not whether any particular individual changed his or her behavior but whether enough people did so to bring about improvements in the general welfare.

This is not an abandonment of our traditional emphasis on the individual; that emphasis has been too successful to discard it just because it is not successful in solving all problems. It is simply a realization that not all problems are susceptible to the same kinds of solutions. To make the general contributions of which our science is capable, behavior analysts will have to use methods of wider generality, in the sense that they affect many people at the same time—or within a short time, without our necessarily being concerned about any particular members of the relevant population.

I wish I had come to that conclusion while Fred was still with us. The generalized conditioned reinforcement he provided was so valuable to me that it became a necessity, and now I miss it. Indeed, I remember one of the last big ones he sent my way. It came when he told me that he was giving my book, *Coercion and Its Fallout* (Sidman, 2000), a thorough reading so that he could present it for discussion in the book club of which he was a member, along with a number of his neighbors.

I, myself, however, am reaching the stage when I am probably making my own near-final remarks—I am certainly among the oldest of Fred's surviving students; perhaps I am even the oldest. If only Jim Dinsmoor had not left us so recently, he could have made that claim. Jim and I had both been scheduled to initiate the Fred Keller lecture, and he would have had many relevant and valuable things to say. But now that I am possibly the oldest of the Keller extended family, I am not sure whether Fred could any longer have shaped useful behavior in me. Many of you here, however, have enough time remaining to take behavior analysis to its next level, to add to its individual clinical applications techniques analogous to those of the public health professions. I hope I have enough years left to see that happen, and perhaps to be able to

provide some generalized conditioned reinforcement for those of you who move in that direction.

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